SXT Mirrors Manufacturing

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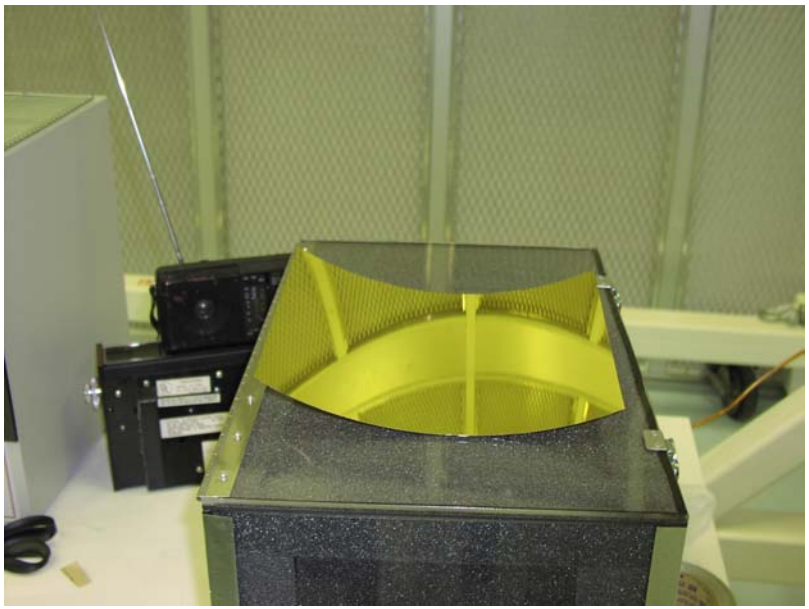
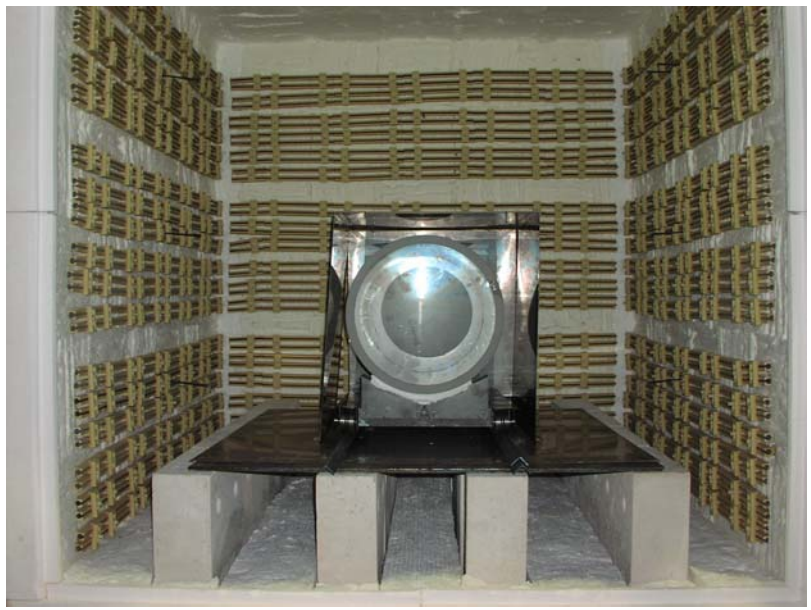
Specifications



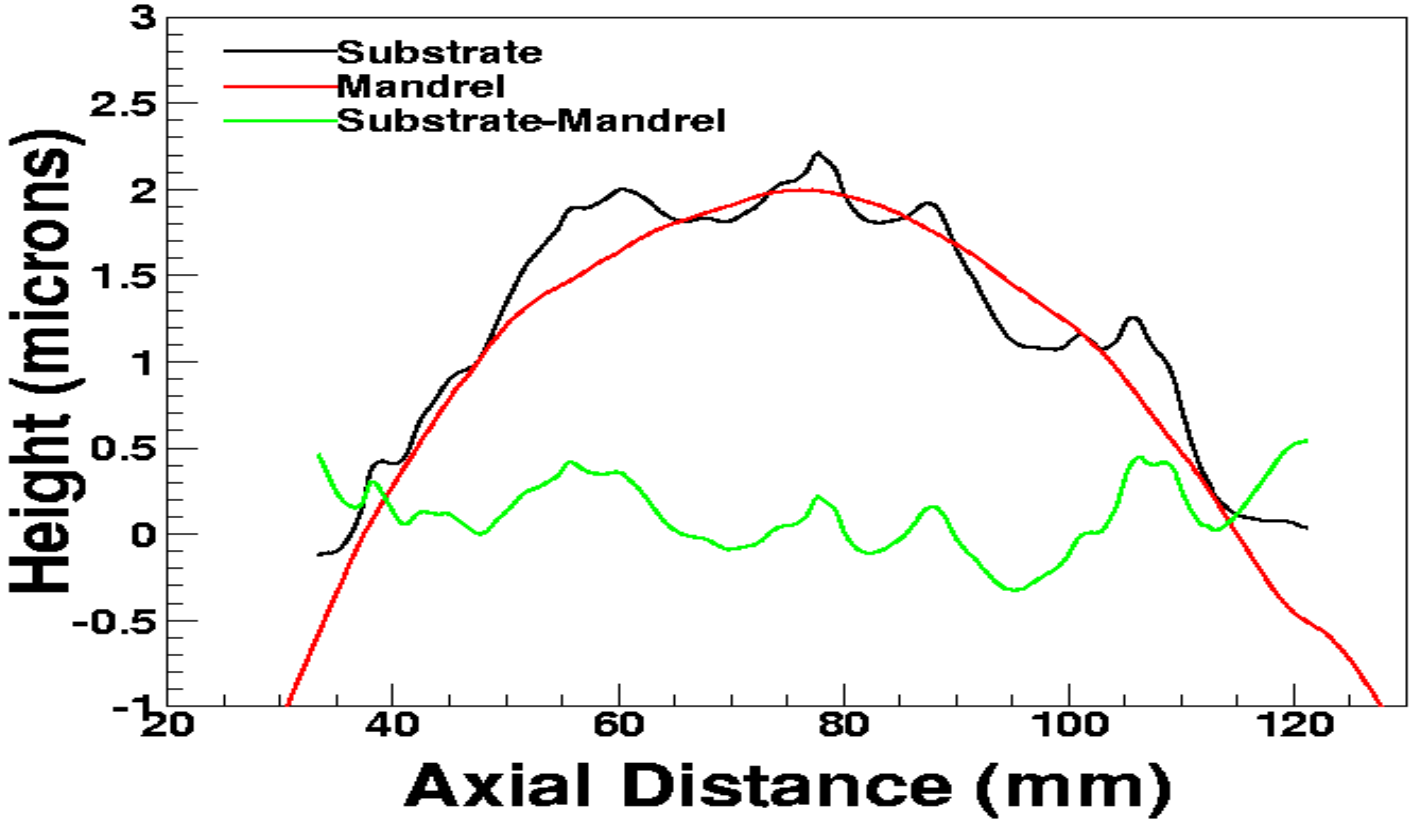
- Operating temperature range: 1 degree C
- Axial slope error: < 2” RMS
- Roundness: <5 μm
- Bottom Edge: < 25 μm deviation from plane perpendicular to optical axis
- Microroughness: < 4 angstroms (RMS)
- Thickness: 400 μm (glass) + 40 μm (epoxy) = 440 μm ====> 280 kg per mirror assembly (417 kg allocation)

Slumping Substrates



- Schott D263 glass sheets (400 μm)
- Conical mandrel made of fused silica: maximum deviation from Wolter-I mandrel less than 2 μm
- Substrate ripples: < 0.5 μm RMS
- Maximum deviation from forming mandrel: < 2 μm

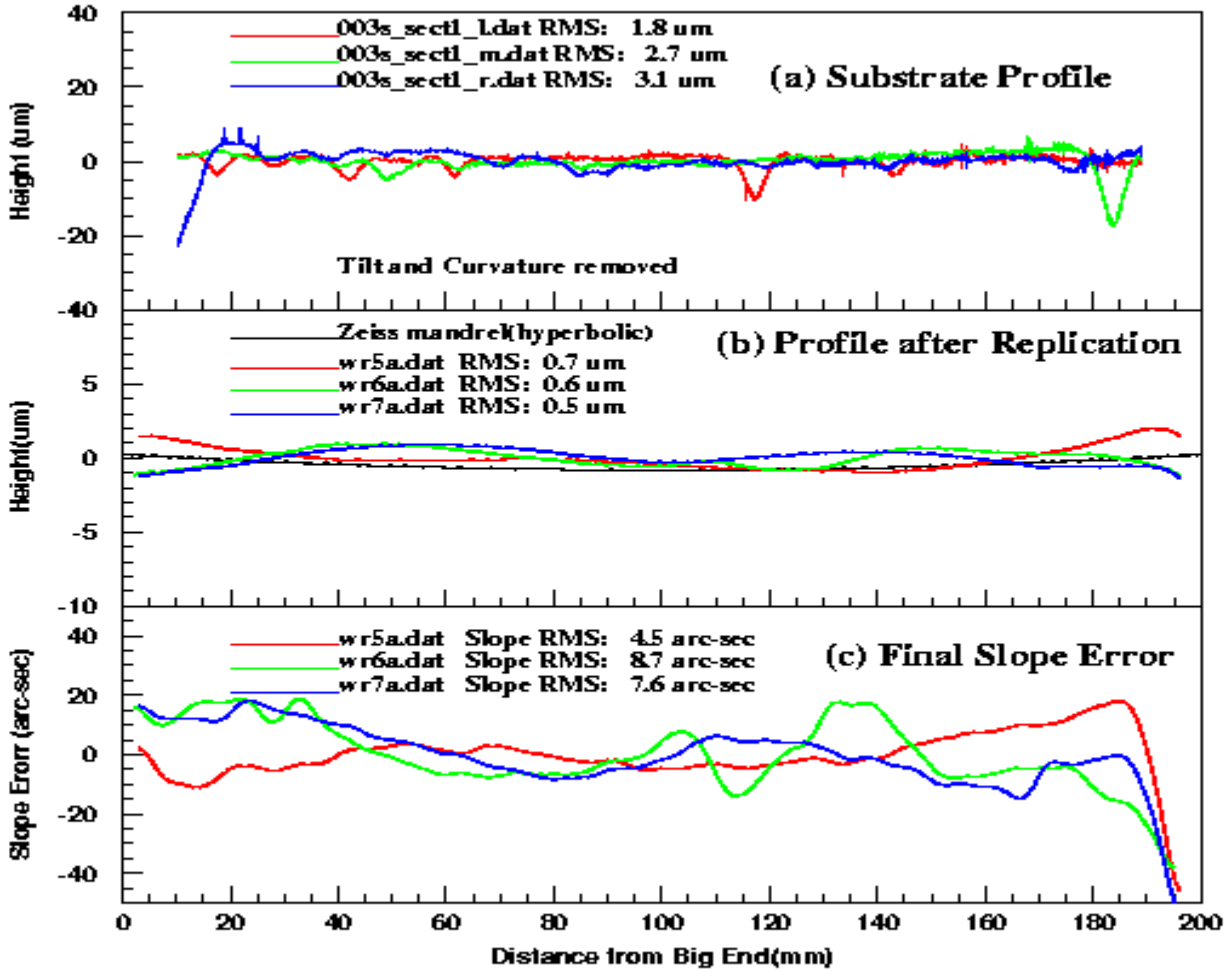
Comparison of a Substrate and Its Forming Mandrel



Epoxy Replication

- Replication mandrel: Wolter-I's made by Zeiss, Axial error ~ 1" RMS
- Epoxy sprayed (40 μm)on substrate
- Mandrel and substrate mated in vacuum
- Epoxy cured at temperature <40 degrees C
- Separation from the mandrel

2001/11/08 14.12



State of Knowledge

- Slumping process does meet requirements:
  P-V < 2μm and RMS < 0.5μm
- Glass edges can be cut to be free of fractures
- Replicas resemble the mandrel to better than 3” RMS (small mirrors) and ~6” (large mirrors)
- Epoxy application and the substrate/mandrel mating are crucial in making good replicas
- Replica-Mandrel separation process introduces temporary distortions which relax over a period of several days

Plan for Next Year

- Acquire satisfactory forming mandrels (March 2002):
  Roundness error < 5μm
  Straightness P-V < 2μm
- Improve slumping environment to reduce ripples < 0.5μm (December 2001)
- Design and fabricate a precision glass cutter to meet requirements on bottom edge (April 2002)
- Improve epoxy application techniques to ensure better uniformity and control (January 2002)
- Improve replica-mandrel separation technique to minimize distortion (December 2001-January 2002)
- Next replication will take place March 2002